

How boundary objects help to perform roles of science arbiter, honest broker, and issue advocate

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Abstract

We examine roles and knowledge by which researchers can enhance connections between science, policy, and society. We arranged a participatory scenario workshop with representatives from environmental administration to discuss how different land-use governance arrangements link to sustainability of reindeer herding in northern Finland. We used fast track scenarios as boundary objects that aimed to bring reindeer herders' problem definitions to be discussed with administrators. First, we performed the role of science arbiter by using our previous research with reindeer herders as the starting point for the discussions. Next, we discussed and elaborated diverse future alternatives via the role of honest broker. Finally, we were interpreted as issue advocates because the scenario exercise reduced the scope of preferable policy options for administrators. Performing these boundary-spanning roles in the same process, but each, in turn, enables researchers to offer views on sustainability via scenarios that break easily acceptable conventions.

Key words: administrators; boundary spanning; environmental change; exploratory scenarios; land use governance; reindeer herding

1. Introduction

To address wicked environmental problems, such as climate change, biodiversity loss, and unsustainable land use, caution is needed regarding the selection of involved actors, approaches, knowledge, and processes by which the separate, but interlinked, societal domains of science, policy, and society are aimed to be connected (Sarewitz 2004; Farrell 2011; Popa et al. 2015; van der Hel 2016; Peters 2017). Crouzat et al. (2018) discuss three well-known roles that can be employed by scientists to connect science to policy. First, scientists can perform a role of science arbiters (Crouzat et al. 2018). In this role, scientists aim at speaking truth to power (Hoppe 1999), implying that scientists think that policy decisions should follow their advice. This role relies on an ideal of a robust scientific method and aims to promote the use of scientific knowledge in policy (Carroll et al. 2017). Secondly, scientists can be honest brokers (Pielke 2007; Rantala et al. 2017; Crouzat et al. 2018). The role of an honest broker implies that scientists focus on making sense together with policymakers and co-produce knowledge together with policymakers and societal actors (Hoppe 1999; Turnhout et al. 2013). This role relies

on ideals of deliberation among diverse viewpoints emerging from science, policy, and society and on the premise that scientists can act as facilitators between the diverse views (Pohl 2008). Thirdly, scientists can perform the role of issue advocate (Sarkki and Karjalainen 2012; Crouzat et al. 2018). Even if the role of issue advocate can be criticized (e.g. Sarewitz 2004), Pielke (2007) considers advocacy as part of healthy democracy. Advocacy can relate to many issues and can be used, for example, to empower local communities via participatory action research (Hukkinen et al. 2006).

Current literature considers that the above roles are divergent from each other and each is suitable to specific contexts or types of problem addressed (i.e. honest brokerage under high uncertainty and stakes; science arbiter when uncertainty is low and policy questions can be answered by using science; and issue advocacy when science can reduce the scope of available policy choices) (Pielke 2007; Rantala et al. 2017; Crouzat et al. 2018). In the present article, we show how we used each of the three roles in the same knowledge co-production process, but each in turn.

We examine a participatory scenario workshop, which we, as researchers and facilitators, organized with environmental

administrators. The workshop aimed at deliberating future options on land-use governance in northern Finland and at bringing reindeer herders' perspectives under discussion with the administrators. A recognized key challenge in northern Finland is to enhance sustainable coexistence of land uses including forestry, nature conservation, tourism, mining, reindeer herding, and hunting involving actors with divergent education, values, knowledge, concerns, and objectives (Sarkki 2011; Heikkinen et al. 2012, 2016; Sarkki and Heikkinen 2015; Kröger and Raitio 2016; Uusitalo 2017). The attendants of the workshop were from environmental and economic administration and from sectoral research institutes from the local, regional, and national levels, with various interests. Our organizing team consisted of university researchers and a doctoral student specialized in social scientific research on land-use governance in northern Finland especially from reindeer herders' perspective and assisted by two master's degree students.

We used so-called fast track scenarios to evoke discussions among administrators on the potential future governance options and especially emphasizing implications of scenarios on reindeer herding. Fast track scenarios are prepared by the researchers before the actual workshop or interaction event. The reason for preparing scenarios beforehand is to speed up the progress when the time for discussion is limited for participants (Kok et al. 2011). We chose to use fast track scenarios as a starting point for discussions because it reflected a previous approach where reindeer herders' views were first mapped with participatory studies and interviews and then resulting scenarios were brought to be discussed among administrators and stakeholders (Hukkinen et al. 2006). We considered fast track scenarios as a fruitful methodological option because the representatives of National Ministries, regional administration, and local officials of remote municipalities are busy and had to travel long distances to join the workshop. We also selected the joint meeting location carefully to be equally reachable from the southernmost capital to the northernmost municipality in the indigenous Sámi area. Due to the historically contested relationships between different land-use administrations and land users, we assumed that finding consensual recommendations for the future was not likely.

In this article, based on the workshop, we analyse how science can be connected to policy. We focus on the exchanged knowledge, and the process in which knowledge is elaborated (c.f. Cash et al. 2003). First, we used the concept of boundary spanning to examine what kinds of roles were taken by the workshop facilitators and other participants in the multiactor interaction process. In the workshop, we employed boundary-spanning roles that can help to cross the boundary between two or more sectors, societal domains, knowledge systems, or actor groups (Aldrich and Herker 1977; Safford et al. 2017). Boundary spanners (e.g. facilitators of collaborative processes) 'aim to be reflective and comprehensive about identifying perspectives and values within a process, including their own and those of the scientists involved, so that those values are explicitly recognized and accounted for whenever possible' (Bednarek et al. 2018). Secondly, we consider the used fast track scenarios as boundary objects (White et al. 2010). Boundary objects (e.g. graphs, concepts, scenarios, and maps) may be used as tools in knowledge co-production processes and other multiactor collaborative processes to allow diverse actors to work together without a prerequisite for consensus (Star and Griesemer 1989; Star 2010; Baggio et al. 2015; Mäenpää et al. 2016). Scenarios are widely used to co-produce knowledge, integrate various normative positions, cope with uncertainty, and enhance possibilities for making strategic choices for future sustainability (Reilly and Willenbockel 2010; Carlsen et al. 2012; Vervoort et al. 2014).

Our objective in the present article is to examine the roles and knowledge by which scientists can enhance connections between science, policy, and society. The arranged workshop is used as a case study where we used fast track scenarios as a boundary object. During the workshop, we performed boundary-spanning roles related to facilitating discussions between diverse perspectives, to bringing herders' views into discussions, and to presenting results and ideas from our previous research. Examinations of such micro-level processes and exchanged knowledge can serve as illustrative case studies by functioning as 'living labs' illustrating key dynamics relevant for interactions between science, policy, and society at various levels (Laakso et al. 2017).

The sections following the introduction present our conceptual approach and methodological framework for examining the workshop dynamics and discussions. Then, we present the results of our analysis on the workshop dynamics identifying diverse ways by which we, as researchers and facilitators, aimed to connect science to policy and responses of other workshop participants to our approaches. This leads to discussion on proposing a way to connect the concepts of boundary-spanning and boundary objects.

2. Integrating boundary-spanning roles with boundary objects

The concept of boundary has been evolving in science and technology studies since the 1980s with an overarching idea to better understand interactions between science, policy, and society (Orsini et al. 2017). We consider that the boundaries exist between these general societal domains, which are also internally heterogeneous (see Lemos and Agrawal 2006). Boundaries between the different worlds are not sharp but rather characterized by collaborative space between the distinct worlds (see Star 2010). Therefore, conventional assumptions on neutrality of experts and on simplified relationships across the boundaries between science, policy, and society need to be replaced by the realization that the boundaries are crossed and maintained in complex and multidirectional interactions (see Pülzl and Rametsteiner 2009; Palmer et al. 2019). Ideally, scientists can arrange knowledge co-production processes in a way that helps to blur the science-policy-society boundaries (Pohl 2008; Carmen et al. 2018).

2.1 Boundary-spanning roles

We use the concept of boundary spanning (Dąbrowski 2018; Palmer et al. 2019) instead of a concept of 'boundary work', which emerged to describe ways by which scientists can demarcate science from non-science (Gieryn 1983). There are two reasons for this. First, while the original idea in boundary work was to pay attention to demarcation, the boundary-spanning concept understands the boundaries as constantly evolving continuums (Evans and Scarbrough 2014). Bednarek et al. (2018) point out that: 'While some may prefer terms other than "boundary spanning," we use it as a starting point for a discussion of the practice of connecting science and policy'. Secondly, boundary spanning is more clearly attributable to boundary spanners than boundary work to boundary workers. We as workshop facilitators, therefore, can refer to ourselves as boundary spanners, who use boundary objects to connect science, policy, and society (see Levina and Vaast 2005). In the present article, we analyse the three boundary-spanning roles: science arbiter, honest broker, and issue advocate as defined in the Introduction section. These roles can be adopted by scientists during their attempts to

blur the boundaries between science, policy, and society (Crouzat et al. 2018).

Issue advocacy is often considered as eroding the neutrality of science and as the opposite to honest brokerage (see Sarewitz 2004; Van der Sluijs 2005). However, unrecognized and hidden ‘stealth issue advocacy’ can also erode trust towards science. Stealth issue advocacy is characterized by claims towards neutrality, while in reality there is an underlying agenda (Pielke 2007). This stresses that issue advocacy is characterized by tensions and possible drawbacks, while at the same time, it is considered as fundamental to healthy democracy (Pielke 2007). In the present article, we like to draw attention to the roles we performed; however, recognizing that we cannot fully control perceptions and interpretations of other workshop participants on the roles we performed. In fact, scientists’ efforts to contribute to policy discussions may be considered as issue advocacy even if the scientists would consider themselves as honest brokers or science arbiters.

2.2 Boundary objects

We used scenarios as boundary objects to mediate workshop discussions. Boundary objects are ‘plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites’ (Star and Griesemer 1989: 393). Star (2010) notes that, most commonly, boundary objects are examined and considered via the concept of interpretive flexibility, which basically allows work without consensus. Interpretive flexibility allows boundary objects to be shared by several different communities but viewed or used differently by each of them (Star 1988; Baggio et al. 2015). The strength of the concept is that it can be interpreted and used by actors on each side of the boundary between societal domains (Star and Griesemer 1989; Guston 2001; White et al. 2010). Therefore, boundary objects offer a means to ‘translate, negotiate, debate, triangulate and simplify’ (Star and Griesemer 1989: 389). Boundary objects can be used as mediating devices by which researchers can help to navigate between the diverse views (Pohl 2008; Carmen et al. 2018).

The idea of dynamics between preliminary and well-structured boundary objects addresses the evolution of the objects. Star (2010) notes that preliminary boundary objects, like fast track scenarios, can be broken down and evolve towards novel formulations based on the interaction between process participants. Boundary objects that are rebuilt after breakdown are often more robust than the preliminary ones. Iterative processes are also important for an effective evolution of boundary objects because they allow breaking initial boundary objects and building new ones (Star 2010).

According to Star (2010), boundary infrastructures are standardized structures that may have evolved from boundary objects as a result of interplay between preliminary and well-structured boundary objects. In

addition, the breakdown of previous objects often functions as a starting point for new boundary objects and even for creation for more standardized boundary infrastructures. Star (2010) lists nine characteristics of boundary infrastructures, which serve multiple communities of practice simultaneously. These nine characteristics relate to various conventions and ideas, co-creation of boundary objects, transparency, their specificity and generality, past developments, and ability to break down objects to create new ones. Boundary infrastructures constitute a broader context within which boundary objects operate (Bowker and Star 1999). Exploratory scenarios as boundary objects have specific structures that help to connect different worlds. Therefore, while boundary infrastructures are to some extent shared contextual structures, boundary object structures help to connect the objects to infrastructures and therefore serve as a link between different worlds. The exploratory scenarios are not meant to predict the future but their strength is their capacity to explore various ways in which the future may unfold. Therefore, rather than the relatively stabilized boundary infrastructures, exploratory scenarios are better understood as being under constant change and evolving by their application in various contexts in knowledge co-production processes, however, assisted by particular kind of boundary object structure embedded in scenarios. We use the nine characteristics of boundary infrastructures by Star (2010) also to define boundary object structures, thereby providing a conceptual link between structural design of boundary objects and infrastructural contexts where they operate.

In the present article, we consider that boundary objects have three defining components: (1) the boundary object structures that connect different worlds together; (2) the dynamics between preliminary and more tailored boundary objects; and (3) the interpretive flexibility.

2.3 Combining boundary-spanning roles and boundary objects

We propose that the concepts of boundary object and boundary spanning can be integrated in a novel way. Combining the concepts of boundary-spanning and boundary objects is in line with recent literature, which has proposed that in addition to examining structural characteristics of boundary objects, focus needs to be also on the interaction processes where boundary objects are used (Turnhout 2009; Jensen-Ryan and German 2019). On the other hand, the three boundary-spanning roles of science arbiter, honest broker, and issue advocate are often considered as mutually exclusive (e.g. Crouzat et al. 2018). Here, we propose that the boundary-spanning roles can be combined in the same process and that boundary object components may be used to support the different boundary-spanning roles (Table 1).

Boundary object structures are related to structure and building blocks of fast track scenarios (e.g. methods and assumptions)

Table 1. Three approaches to connect science and policy and their links to boundary-spanning and boundary objects and related application in our case study.

Relationships between science and policy	Boundary-spanning roles	Components of boundary objects	Our application
Science should define solutions to problems	Science arbiter	Boundary object structures	Design of fast track scenarios
Science should facilitate dialogue between diverse views	Honest broker	Interplay between preliminary and well-structured boundary objects	Process design on how fast track scenarios are used and further developed
Science should reduce the scope of available policy choices	Issue advocate	Interpretive flexibility	Strengthening herders’ perspective in the mindsets of policymakers

developed by us before the workshop. We performed the role of science arbiter by bringing our previous scientific findings to be considered by administrators. Boundary object structures are robust formulations that can be brought into interaction processes from other contexts. Therefore, they are suitable to be used by science arbiters, who aim to bring scientific results into science–policy–society interaction processes. The idea of dynamics between preliminary and well-structured objects links to the role of an honest broker by elaboration of the scenarios according to the views of workshop participants. Interpretive flexibility relates in our scenarios to the idea that we can present scenarios deriving from herders' problem definitions and being relevant for administrators. The idea of dynamics between preliminary and well-structured boundary objects is especially fit to the role of honest broker, which is about an open interaction process, where diverse views are explored and recognized. We aimed to strengthen herders' perspectives in administrators' mindsets and, therefore, our approach can also be interpreted so that we performed the role of issue advocates. Issue advocates can reduce the scope of available policy choices by searching for consensual spaces between diverse worlds that can be connected via boundary objects allowing interpretive flexibility and diversity within the collaborative space. Thus, we link the three components of boundary objects to the policy-relevant roles scientists can perform.

3. Methodology for understanding the workshop dynamics

3.1 The workshop and participants

We arranged the 'Changing North and Challenges of Environmental Governance' workshop as part of the 'Primary Industries and Transformational Change' project, funded by the Research Council of Norway. The workshop took place in Rovaniemi, Finland, on 27 May 2016 with the overall objective to identify and examine the views of environmental administration on the land-use challenges recognized by reindeer herders in a previous workshop (Lépy et al. 2018). Besides the five organizers (university researchers, doctoral, and master students), the fifteen other workshop participants were from the Ministry of Agriculture and Forestry, the Ministry of Environment, regional planning authorities, local municipal administration, sector-based administration institutes linked to forestry, nature conservation and reindeer herding, and land-use relevant research institutes (e.g. Finnish Meteorological Institute and Natural Resources Institute Finland).

For understanding the dynamics in our workshop, it is important to emphasize some characteristics of the workshop. First, the fast track scenarios prepared before the workshop were aimed at functioning as mediating devices for discussions. We developed them based on (1) previous research on reindeer herding (Heikkinen, 2002; Heikkinen et al., 2012; Heikkinen et al., 2011; Sarkki et al., 2016b; Lépy et al. 2018) and (2) pre-workshop interviews with the representatives of environmental administration ($N=21$). These pre-workshop interviews identified knowledge needs regarding climate change and land use (Vanhanen et al. 2016; Sarkki et al. 2016a). Secondly, we selected the invited workshop participants based on the relevance of their position in land-use administration. In addition, many of the invited participants have attempted to reconcile the contradictions between different land uses in their daily work, thereby having hands-on knowledge about land-use governance and also existing relationships to other land users and decision-makers.

3.2 Boundary objects: set of exploratory scenarios

We used fast track scenarios as preliminary boundary objects to provide a basis for workshop discussions. Exploratory scenarios can outline various plausible development paths and their consequences without being policy-prescriptive (Kok et al. 2011; van Vliet and Kok 2015). Scenarios that do not evoke critical discussions or do not pose 'what if' questions often fail in their capacity to mediate discussions as they probably represent how things are already (Hukkinen et al. 2006). We drafted a set of fast track exploratory scenarios before the workshop and sent them to the participants prior to the workshop for reflection. We applied the methodology for developing exploratory fast track scenario storylines (Henrichs et al. 2010; Kok et al. 2011) as follows:

1. we drew on the interviews with environmental administration and on public land-use administration related documents to explore the interrelationships between the various land uses in northern Finland. Reindeer herding has been the key issue in various land-use controversies, and reindeer herding is often a politically sensitive subject due to its connection to Sámi people and rural social equity. We brought herders' views to be considered by decision-makers through structured scenarios, suggesting diverse logics and options to arrange land-use governance (c.f. Hukkinen et al. 2006). The herders' problem definitions on future developments derived from previous scenario exercises (Heikkinen et al. 2012), its elaboration with herders in a workshop arranged in the context of the Academy of Finland's CLICHE project (Impacts of Climate Change on Arctic Environment, Ecosystem Services and Society) (Lépy et al. 2018), and previous social science work on herding (for synthesis Sarkki et al. 2016b);
2. we identified two key pairs of opposite drivers to be explored by the scenarios (Figure 1). The first pair of drivers relates to whether the land-use decisions emphasize securing economic growth or environmental sustainability (c.f. MA 2005; van Vuuren et al. 2012). This is important for reindeer herding, as strong environmental policies may pose restrictions for herding or aim to increase the number of predators in the reindeer-herding district, thereby leading to losses of reindeer to predation. On the other hand, aims for economic growth often link to the expansion of industrial land uses and tourism that lead to the decrease of availability of pastures for reindeer. The second chosen pair of drivers was whether land-use decisions are based on the majority rules or affirmative actions (c.f. UN SDG 10, 2015). Majority rules have been occasionally found challenging for herders as a small group, thereby sustainability from herders' perspective often requires affirmative land-use governance solutions (Sarkki et al. 2018). We first used the term 'positive discrimination', which created confusion among many workshop participants, who recommended changing it because the term was misunderstood and interpreted as resembling illegality of discrimination in general. Nevertheless, the balance between majority rules vs. affirmative actions is important because the indigenous Sámi people and reindeer herders in northern Finland can be considered as minority groups;
3. we added two additional pairs of drivers to the scenarios: whether regulatory governance functions by technocratic and top-down or participatory bottom-up approaches and whether economic guidance is based on unregulated markets or on market-based governance instruments (Figure 1). This was done to add more dimensions to the simplified scenario cross

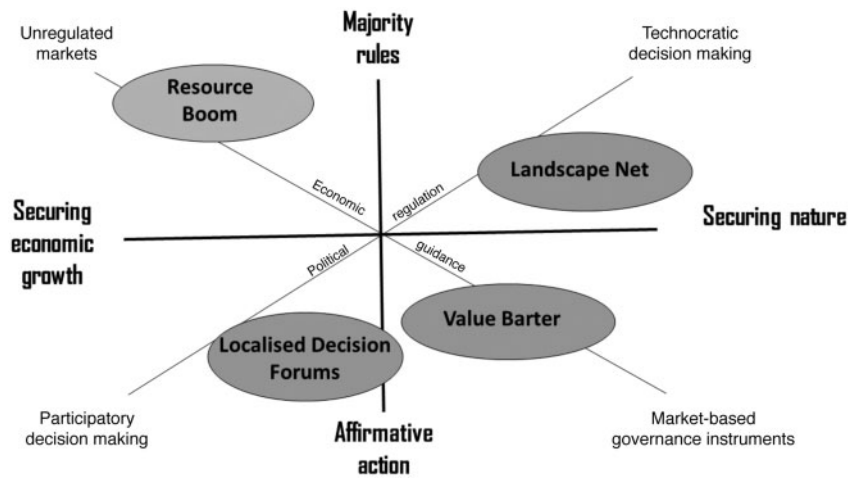


Figure 1. Scenario logics to reconcile conflicting land-use interests discussed in the workshop. The thick cross and the thin × represent different drivers, and their logic is that the four scenarios follow the drivers presented in both the thick and thin crosses. Translated version of the scenario cross discussed in the Primary Industries and Transformational Change workshop (Vanhanen et al. 2016).

Table 2. The titles, logics, and principles for the four scenarios.

	Ensuring economic growth	Protecting nature
Majority rule	<p>Resource boom</p> <p>Logic: Unregulated global markets create economic growth also at the local and regional levels.</p> <p>Principle: ‘Big is beautiful’</p> <p>Land use: Industrial, large scale, and expansive land uses increase</p> <p>Source of empirical idea: common discourses in Finland on the ability of large-scale industrial activities (e.g. mining and forestry) to boost local, regional, and even national economies</p>	<p>Landscape net</p> <p>Logic: Technocratic top-down environmental governance to secure environmental values.</p> <p>Principle: Precautionary principle.</p> <p>Land use: Land use is condensed to small areas, thereby allowing nature to flourish elsewhere</p> <p>Source of empirical idea: interview with a representative from the Centre for Economic Development, Transport, and the Environment</p>
Affirmative actions	<p>Localized decision forums</p> <p>Logic: regional development and local participation</p> <p>Principle: subsidiarity ensures social sustainability</p> <p>Land use: local minority groups get more power in defining land-use decisions</p> <p>Source of empirical idea: ‘Regional large carnivore committees’ in Finland, and ad hoc local negotiations between reindeer herders and Metsähallitus forestry enterprise</p>	<p>Value barter</p> <p>Logic: market-based governance to secure environmental and social values</p> <p>Principle: ‘Polluter pays’</p> <p>Land use: land uses harmful for nature or local people need to compensate the losses. Increase of various incentives, subsidies, and payments to balance the benefits and burdens of land use</p> <p>Source of empirical idea: The Forest Biodiversity Programme (METSO) in Finland, in which compensations are paid for private forest owners for voluntary conservation efforts</p>

- (c.f. Heikkinen et al. 2012) and was based on a finding from earlier literature that the type of governance in terms of political regulation and economic guidance has a high relevance for reindeer herding (Heikkinen et al. 2016; Sarkki et al. 2018);
- we developed narrative exploratory scenario storylines based on the guiding logics and sent these fast track scenario storylines as pre-workshop material for the participants;
 - we presented the scenarios and discussed the scenarios with the participants in the workshop; and
 - based on the participants’ input in the workshop, we finalized the four storylines (published in full in Sarkki et al. 2016a) (see Table 2 and Figure 1).

3.3 Material and methods

To examine how science could be connected to policy in the workshop, we paid attention firstly to boundary-spanning roles by us as facilitators and researchers but also to the workshop participants’ responses to these. Secondly, we examine the participants’ reactions to the fast track scenarios we presented, in other words, boundary objects in action. Thirdly, many dynamics in the workshop also related to the participants’ sociocultural backgrounds, which seemed to explain reactions to our roles as facilitators and the knowledge we presented. Therefore, the empirical analysis is divided under three subheadings: (1) boundary-spanning roles; (2) boundary object scenarios in action; and (3) relevance of sociocultural backgrounds

as explaining the workshop dynamics. These three themes were examined by an analysis of the transcriptions of the recorded workshop discussions and answers in the online feedback form. We also had feedback discussions among the workshop organizers on how the workshop dynamics took place, on the arguments that the other workshop participants made, and on the reactions of participants to each other's comments and positions. In addition, we practiced self-reflexive (Davies 2000) thinking about the social dynamics observed in the workshop. Reflexive thinking was used to make observations on workshop dynamics related to our own approaches, knowledge, and facilitation practices.

We utilized directed content analysis (Hsieh and Shannon 2005) to analyse the above-mentioned workshop materials. We used directed content analysis, which uses broad concepts framing the analysis but allows identification of subcategories under the examined concepts. We framed our analysis by focusing on boundary-spanning roles and boundary objects in action. We then clustered empirical materials linking to these concepts and forming subcategories under the concepts. As a result of the analysis, we identified seven key empirical observations, each forming a distinct subcategory. These seven subcategories link to both process and knowledge and are relevant for the employed concepts and emerged as important in the empirical material. Three categories were formed under boundary-spanning roles, two under boundary objects in action, and two under importance of sociocultural backgrounds, which link to both boundary-spanning roles and boundary objects in action (Table 3).

4. Results of workshop dynamics

4.1 Boundary-spanning roles

We adopted a relatively flexible and freestyle for facilitation, listening carefully to the participants' views rather than dominating the

discussions and redirecting the discussions to specific pre-determined issues. An open facilitation style is conducive to avoiding pre-determined discussions, but free facilitation also allows the participants to focus on themes outside of the scenarios and may not support discussion entries by the participants who are less able and willing to express their views.

Many of the invited workshop participants had difficulties accepting the previously prepared preliminary scenarios as starting points for discussions. The participants, for example, asked whether the fast track scenarios are outdated, wondered where they came from, and proposed that we should generate new scenario(s) based on the workshop, which was the original objective. However, while some participants considered the fast track scenarios as interesting entries for discussions, others were more critical of their utility, arguing that these might lead to confusion and possibly polarization among the participants. This polarization was apparent, for example, in arguments pointing out that reindeer herders' land rights are secured by the law enabling grazing rights including on private and state lands and that, therefore, there is no need for affirmative action. This could imply that some workshop participants did not consider us as neutral facilitators but interpreted us as issue advocates for reindeer herding. On the other hand, doubts of issue advocacy could result in some participants defending their pre-existing organizational positions. However, criticism revealed right away the high, crucial governance tensions that evoked responses and constructive deliberations.

Workshop participants often defended their own views, values, and practices against arguments that would require changes. We designed heterogeneous breakout groups to enrich discussions. Moreover, to make the rather strong normativity visible and understandable, we sought to be open about our agendas. While the presence of normativity is usual in multiactor meetings, we identified some challenges to manage defensive roles constructively. First, defending one's position supports the status quo and defends the

Table 3. Clusters and subcategories based on the analysis of workshop dynamics.

Observation in the workshop	Preliminary conclusion
Boundary-spanning roles We used a rather free and open style of facilitation	This is in accordance with the role of honest broker and encouraged the participants to share their point of views
The fast track scenarios were based on our previous research and represented mainly the perspective of reindeer herding	We were occasionally seen as issue advocates for reindeer herding, which made it difficult to disentangle the roles of science arbiter and issue advocate
Many of the workshop participants defended their organizational interests and practices	The responses of participants to facilitators' roles depend also on participants pre-existing positions, which they aim to guard
Boundary objects in action The preselection of the two key uncertainties employed in the fast track scenarios led to criticism. Participants would have liked to reconstruct the preliminary scenarios	Ownership towards scenarios can be enhanced by allowing purposeful fundamental revision of preliminary scenarios and allowing time for building revised scenarios
The scenarios were not considered realistic but evoked lots of discussions on how to enhance current land-use governance	Caricature-like 'what if' scenarios cross the boundaries of conventional thinking and help to narrow scope of choices that the participants consider as preferable
Importance of sociocultural backgrounds Representatives of the Sámi Parliament were invited but not present in the workshop. Reindeer herders' views were represented by a member of the Reindeer Herders' Association, and the herders' problem definitions were also communicated by facilitators and fast track scenarios	There are always missing stakeholders, but their views may be communicated to some extent by others. This undermines the benefits of face-to-face interactions.
Most of the workshop participants made clear efforts to find solutions for sustainability and not only from a narrow, organization-specific perspective	Despite divergences, there are views and objectives that are to some extent shared, thereby leading to efforts to find solutions for the mutual benefit

current practices against new changes compromising the potential to imagine alternative futures with the help of the scenarios. Secondly, occasionally some of the invited participants argued against each other and defended their organization-based positions. Participating administrators continuously stressed that the extent and quality of herders' opportunities for participation have improved significantly in recent years. Thirdly, the adopted defensive roles (e.g. legal regulation over market-based governance; technocratic expertise against open participation) can be explained by the organizational positions of those making the arguments.

4.2 Boundary objects in action

In the workshop, various critical questions on the key drivers predetermined before the workshop (Figure 1) were posed. The pair of drivers contrasting economic growth and environmental sustainability was challenged by the workshop participants who pointed out that the Western view on wilderness without people does not work in Lapland where most people have a close relationship with nature and a variety of daily (subsistence) activities are done 'in' nature (e.g. hunting, fishing, berry picking, reindeer herding, and recreation). The workshop participants also strongly perceived that economic development must align with environmental sustainability. Therefore, the distinction between economic growth and environmental sustainability in scenarios actually played nature and culture against each other, perhaps artificially.

Furthermore, the drivers of affirmative actions and majority rules were challenged by the workshop participants who stated that the companies outside Lapland operating in Lapland actually boost the regional economy and benefit the local people, including reindeer herders and the indigenous Sámi. However, it was argued that external companies cannot enter Lapland unless they are locally sustainable. Yet there occurred some disagreement over using the term 'positive discrimination' (hence, later changed to affirmative actions) for representing an overly stark critique towards Finnish democracy. Overall, many of the workshop participants felt that the dichotomy of affirmative actions vs. majority rules actually played reindeer herders and Sámi people against majority groups unnecessarily. The participants aimed to build bridges over the assumed gap between herders, administrations, and other land users.

These problems with the key uncertainties in the scenarios led to comments that the examined '*scenarios are somewhat alienated from practice*'. This highlights that the simplified 'either/or' mentality in scenarios did not exist in the realities of the workshop participants and, therefore, made it somewhat difficult for participants to relate to the scenarios. In addition, the fast track scenarios were occasionally considered as unrealistic and overly simplified caricatures in the workshop discussions. A workshop participant even stated that 'they are all so awful and one-sided'. The capacity of the scenarios to also evoke surprising discussions on future dynamics was hindered by calls for more realistic scenarios by some workshop participants. We could have tried to break these limits set by conventional thinking, for example, by providing examples of past large scale and surprising changes. On the other hand, in the capacity of providing near extreme caricatures, the scenarios challenged participants' thinking. First, many participants stated that there is no need to establish additional land-use governance forums as proposed by the 'Localised decision forums' scenario because they felt that current participatory land-use planning processes, which some of them organize, work quite well. This relates to personal views on how land-use governance should be arranged to enhance sustainability. Secondly, a misunderstanding on the scope of

the workshop was apparent in that a participant affiliated to a Ministry considered that the legal aspects should have been discussed more in depth instead of other forms of governance (e.g. market-based, civil society initiated, and science-based decision-making). This reveals that we, as facilitators, and the other participants had in some cases divergent views on the means and processes by which the land-use decisions should be done. Thirdly, many of the participants understood the used scenarios as predictions or fully normative political plans instead of taking the fast track scenarios as food for thought to mediate discussions. This misunderstanding raised criticism because it directed discussions towards the question on whether the scenarios were realistic projections or politically feasible. Lastly, even though the participants criticized the scenarios, the criticism enabled discussions on their existing ideas of land-use governance and its objectives.

On the positive side, the caricatured, simple, and quite extreme scenarios evoked counterarguments that reflected normative stances of the participant in question. In fact, the participants voted by placing sticky notes on the scenario cross (Figure 1) to express their understanding of the current situation. Most votes were placed in the middle of the scenario cross, highlighting that the fast track scenarios were quite imaginative and able to create discussions and test the boundaries of the participants' views on land-use governance going beyond the current situation and that the participants roughly agreed on the current situation in terms of the proposed future uncertainties.

4.3 Importance of sociocultural backgrounds

There are always missing actors in collaborative meetings because not everyone can be included at the same time and most often all the invited actors are not able to attend. For example, we invited representatives from the Sámi Parliament but in the end they were not able to attend. This produced a situation where the Sámi could not speak for themselves and that led to some polarized comments on Sámi land rights. Some participants also raised the issue of internal disagreements within the Sámi communities and considered in relation to the 'Resource boom' scenario that resource use is also an integral part of Sámi culture. On the other hand, our choice to concentrate on the administrations' view led to the decision not to invite herders into the same workshop. Therefore, the discussions on the need for affirmative action towards the Sámi and reindeer herders would probably have been significantly different if the herders and Sámi had been present.

Despite the above-mentioned challenges, the discussions were mostly constructive. There was a visible attempt by the workshop participants, including the most critical ones, to contribute and encourage us to define new scenarios that could help to build bridges between the diverse actors under more inclusive and mutually acceptable land-use governance solutions. The observed motivation to create bridges across—even contradicting—actor groups can be explained by a shared regional identity, which focuses on viable communities and the balanced well-being of the people and nature of Finnish Lapland. Therefore, the fast track scenarios revealed shared motivations to develop mutually acceptable visions for organizing the land-use governance in northern Finland.

5. Discussion: Three approaches to link science and policy

5.1 Scenarios by science arbiters

In this section, we consider how the boundary object structure of the fast track scenarios functioned as a tool for us as science arbiters.

Table 4. Nine characteristics of boundary object structures and their linkages to fast track scenarios as applied in the case study.

Boundary object structures	Fast track scenarios as boundary objects	Lessons learned to be used by science arbiters
Embeddedness (links to existing ideas, structures, and discourses)	Established scientific methods to build exploratory fast track scenarios	Scenarios offered a robust way to bring previous scientific findings and a method to structure the findings into the workshop discussions
Transparency (visibility of underlying assumptions)	Scenario cross (Figure 1) and explanation of scenario, logics, storylines, and their implications for practice	Scenarios offered a condensed and visual presentation of various futures identified by scientists based on our previous research on reindeer herding and land-use governance
Reach and scope (relevant in various localities and for various communities)	Scenarios relevant for various stakeholders with application potential beyond single case	Participants recognized the general trends communicated by scenarios but felt occasionally that the scenarios remained alien to them
Learned as part of membership	Participatory workshop where scenarios are discussed by considering participants as experts	Scenarios provided a possibility for a two-way dialogue between policymakers and researchers to discuss and elaborate our previous research
Links with conventions of practice (shapes and is being shaped by conventions)	Scenarios informed plausible future solutions and were based on previous research	Scenarios represented researchers' conventions of practice shaped by problem definitions of reindeer herders and were subjected to modifications by participating policymakers
Embodiment of standards (links to other standards)	Scenarios used standard assumptions on dualistic drivers: nature vs. economy and affirmative actions vs. majority rules	The dualistic assumptions concerning the ways by which to bring science into discussions were occasionally questioned
Built on installed base (e.g. path-dependent processes and existing structures matter)	Scenarios were based on long-term research interactions with reindeer herders	Implications of future land-use governance options for herders were brought under discussions to inform administrators' views
Breakdown of initial boundary objects to build more robust ones	We used fast track scenarios as starting points to be elaborated by the participants	To create more participant-led scenarios, more time would have been required
Fixed in modular increments (changed by the participants)	Scenario workshop allowed personal reflections on scenarios	Participants had a possibility to discuss scenarios from their own perspectives

We utilized nine characteristics for boundary infrastructures from Star (2010) to link them with the employed fast track scenarios and draw lessons learnt (Table 4; See Section 2.2).

Table 4 highlights that there are various issues to think of when designing fast track scenarios to be used by science arbiters. First, the methodological choice to use fast track scenarios is productive in terms of bringing in scientists' views to be considered by administrators. The sense of ownership, enhancing potential for the knowledge use in practice, can be increased by purposeful breakdown of the fast track scenarios to give room for new scenarios. In our workshop, the breakdown took place, and one of the final comments by workshop participants was a hope for us to build new scenarios based on the workshop. Therefore, it would be advisable to reserve more time, and if possible, a separate session for rebuilding scenarios after the breakdown of the fast track scenarios. Secondly, our position as science arbiters was occasionally challenged by some of our pre-workshop choices embedded in the fast track scenarios (e.g. chosen methods to produce the scenarios, the chosen perspective of the scenarios, the implicit views that some scenarios are better than others, and whose perspective the scenarios mainly represent). Therefore, transparency is important for science arbiters.

5.2 Scenarios by honest brokers

Here, we consider how the dynamics between preliminary fast track scenarios and more structured scenarios can improve deliberations facilitated by honest brokers. Boundary objects are 'stuff of action' and can be made more robust by processes that enable participants to go back and forth, and across actor groups in the interpretation of the boundary objects and as a result revise or create new boundary objects (Star 2010). With the case of our workshop, this possibility was compromised by our conscious choice to include herders'

views in the fast track scenarios without herders' physical presence. Also, the fast track scenarios seemed to be misunderstood by some workshop participants as ready-made proposals instead of a basis on which to elaborate. The workshop participants wished they could build their own scenarios. An alternative scenario development process could have been used to cope with the identified challenges in using the fast track scenarios and to further strengthen open deliberation.

As an alternative to using the fast track scenario cross, the workshop facilitators could pre-determine the initial list of important drivers, and the workshop participants could then complement the list (c.f. Nilsson et al. 2017). A deviation from the established scenario methodologies would be to replace the scenario cross (e.g. MA 2005) by letting the participants select five (a number that allows for heterogeneity but that is still manageable) of the most important drivers. The participants could then choose which driver combinations they want to explore in the workshop. Furthermore, in the proposed methodology, the purpose is to move away from a dualistic approach where the thinking follows the logic of opposite issues, for example, nature and culture, or affirmative actions vs. domination of the masses. This proposal, which emerged after the workshop, is visualized by 'star-shaped scenarios' (Figure 2). The selection and importance of the proposed five drivers for the land-use governance in northern Finland can be debated, but the ones displayed in the figure were identified as relevant in the pre-workshop interviews and touched upon in the workshop (Vanhanen et al. 2016; Sarkki et al. 2016a).

5.3 Scenarios by issue advocates

Here, we consider how scenarios were used by us as issue advocates utilizing the interpretive flexibility of scenarios as boundary objects. Based on the workshop dynamics, we detected two ways in which the

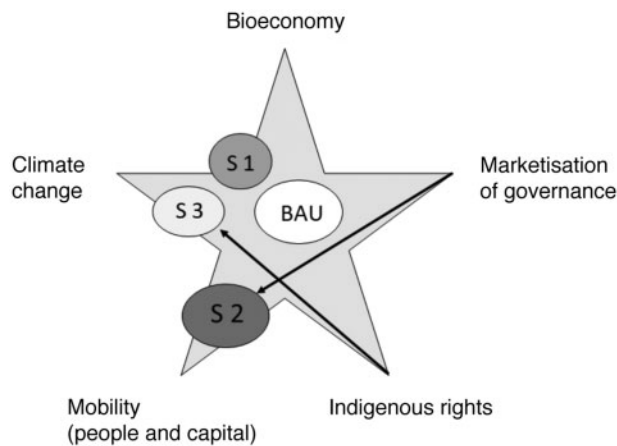


Figure 2. An example to illustrate the star-shaped scenarios. The ends of the star skeins are five drivers that were discussed in the pre-workshop interviews and at the workshop. The five drivers are not directly linked to each other like in the standard scenario cross. This makes the visualization more flexible. The balls within the star represent examples of scenario logics positioned divergently in relation to the drivers. The number of scenarios to be explored by star-shaped scenarios is open. Each scenario logics can combine one or more drivers. The scenario balls presented in the star provide logics for building new scenarios, which the workshop participants wanted to be developed based on the workshop. The business-as-usual scenario is located in the middle. S 1 provides logic where the implications of bioeconomy discourse are increasingly affecting land-use decisions in combination with debates on how the European Union considers the role of forestry in climate change mitigation. S 2 represents a scenario logic in which global tourism and mining are increasing in northern Finland and governed by market-based ways (e.g. social licencing by mining companies; commercialization of wilderness and ecotourism). S 3 represents an Arctic scenario where climate change mitigation and adaptation are governance priorities and indigenous peoples' rights increasingly recognized in politics.

scenarios reduced the scope of land-use solutions perceived as preferable by the workshop participants: by leading to search for solutions beneficial and acceptable to everyone and by presenting options that were not perceived as preferable by the workshop participants.

First, interpretive flexibility of boundary objects implies that the boundary objects are robust and can combine various perspectives under a shared identity (Star and Griesemer 1989). Therefore, interpretive flexibility in scenarios can lead to finding solutions that are beneficial to many actors. We found that the scenario exercise pushed the boundaries of conventional thinking and facilitated thinking about the future from the point of view of the caricature-like rather extreme scenarios (see Normann 2001; Lang and Ramirez 2015). The caricature-like scenarios led to various comments from the workshop participants to enhance the mutual well-being of inhabitants and all the land users in Lapland despite the occasional confrontations. Most of the workshop participants seemed to hope for mutually beneficial solutions and were quite optimistic about the future. We assume that this is due to the sense of common regional identity that focuses on advancing the well-being of the people and nature of Lapland. Regional identity can be defined as relationships of actors to symbolic, territorial, and institutional processes (Paasi 2002). The workshop discussions aimed at discussing land-use governance in the territory of Finnish Lapland, and discussions also considered various symbolic aspects, such as unique nature, sustainable human–environment interactions, and reindeer herding. The sense of shared identity helped to move beyond potential conflicts to see commonalities and common benefits

among all diverse actors inhabiting Lapland or making decisions on land use in Lapland. Secondly, the caricature-like scenarios led to a comment by one participant that *'they are all so awful'*. This can be seen as reducing the scope of land-use decisions that the participating administrators' considered as sustainable, as clearly the caricature-like scenarios were not considered as preferable.

6. Conclusion

The conceptual innovation in the present article is the combination of boundary-spanning and boundary object concepts under three approaches: (1) use of design of boundary object structures by science arbiters; (2) use of dynamics between preliminary and well-structured boundary objects by honest brokers; and (3) use of interpretive flexibility of boundary objects by issue advocates. The current literature considers that the boundary-spanning roles are divergent from each other and each is suitable to specific contexts or types of problem addressed (e.g. Pielke 2007). However, the three roles should be understood as being potentially used in the same process, but each in turn. Yet it should be noted that interaction between people is so multilayered that drawing clear lines between specific roles may be hard. Therefore, in contrast to previous literature, it seems realistic that while different roles are ideally suited in certain situations, they are likely to be blurred in reality. In the workshop, we used fast track scenarios based on previous research, brought them into discussion with administrators exploring diverse views with an objective to work towards finding a shared collaborative space in the form of new scenarios to inform sustainable solutions in future processes blurring science, policy, and society. We conclude that our approach had both positive and negative sides.

The most visible negative aspect in our methodology was that the agenda did not include enough space for participants to build their own scenarios after the breakdown of the fast track scenarios. If the participants would have had more time for building their own scenarios, then it could have led to more robust scenarios becoming new boundary objects to be shared via the role of science arbiter in subsequent collaborative processes. Section 5.2 provided some proposals on alternative scenario building methods suggesting that combining the roles of science arbiter (fast track scenarios) and honest broker (discussing the scenarios) would benefit from a clear method to create a new set of scenarios. Secondly, the workshop showed that while we aimed at being rather neutral, our approach was occasionally interpreted as advocacy leading to defensive responses by some workshop participants. In the case of our workshop, we can say that we aimed to bring herders' perspectives into the policymakers' mindsets through a scenario exercise and by those means inform the administrators' choices for sustainable land-use decisions. While this is not a strong form of issue advocacy, still masking even soft forms of advocacy behind claims of neutrality may not be productive.

On the positive side, the three considered roles work productively together by combining many strengths of science: ability to produce robust knowledge, ability to work in the middle, and ability to narrow down the scope of sustainable policy choices. Therefore, new experiments in combining these roles in the same process are needed. In the present article, we have provided an example, which can help in future experiments that blur the boundaries of science, policy, and society.

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